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Author(s): Anaya, Lillian Marie
Adkins, Kenneth Brian

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Operational and Mission Highlights

A MONTHLY SUMMARY OF TOP ACHIEVEMENTS

February 2022

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24-Hour Operations to Support Pit Mission Begin at TA-55

To support the Laboratory's pit mission, the Associate Laboratory Directorate for Plutonium Infrastructure on January 31, 2022, took the first step in establishing operations at TA-55 that run 24 hours a day, seven days a week.

For the next few weeks, field execution teams will work 24-hour, four-days-per-week shifts. On February 28, 2022, these teams will work to increase coverage to seven days per week, with a rolling schedule for the graveyard shifts. Day shifts on Friday, Saturday, and Sunday will be reserved for maintenance activities at the facility. Round-the-clock operations at the Laboratory's Plutonium Facility (PF-4) will enable safe, efficient modernization of that facility while still ensuring that currently planned work remains productive.

These new work schedules will immediately introduce logistical improvements, including reducing the amount of traffic through the East Entry Control Facility, alleviating parking congestion, and ensuring other critical work does not interfere with daytime production work at PF-4. Throughout all shifts, workers will conduct construction, equipment removal and installation, and operations and maintenance activities. Such work will begin with both the continuation of decontamination & decommissioning and clean installation projects.

Implementing these shifts, which are the result of a months-long collaboration that required research, discussion and problem solving among Laboratory leadership, represents the Laboratory's first large-scale effort to execute critical infrastructure projects and subsequently pit production based on such a schedule. Moving forward, the Laboratory will benefit from institutionalized gains that have come from emphasizing safety, accountability, and high standards in the conduct of all operations.

First Two-Year Measurements Complete on the Cross-Platform Plutonium Aging Project

Personnel assigned to the Laboratory's Cross-Platform Plutonium Aging Project recently completed a series of measurements to study the thermophysical property evolution in delta phase plutonium over its first two years of life. This set of plutonium samples, originally

cast and heat treated in 2019, has been characterized at regular intervals over the past two years to monitor changes in

- attice parameter,
- bulk volume (lattice swelling),
- elastic moduli under ambient pressure and temperature conditions, and
- at elevated temperatures to track changes in the phase boundary locations and stored energy content.

This early time characterization, along with supplemental measurements on moderate (approximately 15 years) and mature (approximately 40 years) samples that are scheduled for FY22-FY23, will provide the validation basis for advanced atomistic calculations that capture the influence of aging, through the addition of defects, on similar property changes.

Scorpius Conducts Final Design Reviews

During several weeks in December 2021 and January 2022, the Enhanced Capabilities for Subcritical Experiments (ECSE) Advanced Sources and Detectors (ASD) Project conducted a series of Final Design Reviews for all major subsystems associated with the Scorpius accelerator. The success of these reviews led to the accelerator's approval for fabrication.

In addition to the Final Design Reviews, ECSE ASD planned to perform additional design-review sessions during the week of January 24, 2022. These additional reviews would address any outstanding issues or questions. However, after consultation with the Committee Chair and the Federal Project Director (FPD), it was agreed that all systems had been adequately reviewed and that the completed session closed out the review process for Scorpius.

Following closure of the recommendations, a summary statement from the committee is as follows: "The FDR has demonstrated that the ASD Scorpius design is sufficiently mature for Final Design Review approval and ready for CD-2/3 submittal." CD-2/3 combines Critical Decisions 2 and 3; for ASD, it requires Deputy Secretary of Energy approval for the design, cost, and schedule. Upon approval, Scorpius fabrication, assembly, and installation can begin.

An accelerator capable of generating X-ray images of subcritical implosion experiments, Scorpius will enable scientists to conduct studies of what happens to plu-

onium during the final stages of a nuclear weapon's implosion. Named after the brightest extrasolar X-ray source visible from Earth, Scorpius will be located at the U1a underground laboratory at the Nevada National Security Site.

Transuranic Waste Processing Cuts Down Material-at-Risk Volume

On January 27, 2022, the Nuclear Process Infrastructure group, with the support of Material Control and Accountability and Radiation Control, sent 30 transuranic (TRU) waste containers to N3B for real time radiography, in addition to what remained of their WIPP-certified characterization. All containers consisted of 55-gallon drums formerly located at the TA-55 container storage unit 480 Pad, an open-air permitted TRU waste storage area. With the transfer of these 30 containers, the 480 pad realized a net material-at-risk (MAR) reduction from 50 percent to 26 percent of MAR limit, along with the associated volume reduction. Achievements like these continue to help making way for continued plutonium-operations missions.

SCIENCE, TECHNOLOGY, AND ENGINEERING

Capturing Hidden Data for Asymptomatic COVID-19 Cases Provides a Better Pandemic Picture

Asymptomatic COVID-19 cases are the bane of computer modelers' existences because they throw off the modeling data to an unknown degree. To tackle this issue, scientists from the Laboratory's Theoretical Division are exploring the use of historic epidemic data from eight different countries to estimate the transmission rate and the fraction of underreported cases.

Nick Hengartner of the Theoretical Division's Center for Nonlinear Studies (T-CNLS) and Imelda Trejo Lorenzo of Theoretical Biology and Biophysics (T-6) presented a Bayesian method to estimate the transmission rate and fraction of underreported cases. As tested against the data of Argentina, Brazil, Chile, Colombia, Mexico, Panama, Peru, and the U.S., the new approach directly describes the dynamics of the observed, underreported cases. The duo's resultant paper, "[A modified Susceptible-Infected-Recovered model for observed](#)

[under-reported incidence data](#)," was published in the Public Library of Science (PLOS) journal *One*.

Freshwater Outflow from Beaufort Sea Could Alter Global Climate Patterns

In a recent modeling study, researchers analyzed the mechanics associated with a scenario in which a rapid release of freshwater into the Atlantic Ocean wreaks havoc on the delicate climate balance that dictates global climate. The study was performed by members of the Laboratory's Computational Physics and Methods (CCS-2) and Fluid Dynamics and Solid Mechanics (T-3), in collaboration with the University of Washington and the National Oceanic and Atmospheric Administration.

The team initially studied a previous release event that occurred between 1983 and 1995. Using virtual dye tracers and numerical modeling, researchers simulated the ocean circulation and followed the spread of the freshwater release. The model used in the study, known as the Energy Exascale Earth System Model version 0 (E3SMv0), incorporates the Laboratory's Parallel Ocean Program (POP) and its powerful sea-ice model, CICE.

According to co-author Wilbert Weijer (CCS-2), this work is a great example of the Lab's innovative ocean modeling approaches; it also demonstrates the Laboratory's leadership in high-latitude climate science through projects such as the High-Latitude Application and Testing of Earth Systems Models (HiLAT-RASM). The research team members from the Laboratory are Jiaxu Zhang, Wilbert Weijer, and Tarun Verma, all of CCS-2, as well as Milena Veneziani of T-3. The paper, "[Labrador Sea freshening linked to Beaufort Gyre freshwater release](#)," was published in *Nature Communications*.

Laboratory Scientists Develop xRAGE, a Newly Advanced Code to Conduct Experiments in Inertial Confinement Fusion and High-Energy-Density Physics

For several decades, scientists at the Laboratory's Advanced Simulation and Computing (ASC) program have been developing the xRAGE (short for x-division's Radiation Adaptive Grid Eulerian) simulation code. Thanks

to several recent developments, this code has become an advanced tool capable of modeling experiments in Inertial Confinement Fusion (ICF) and high-energy density physics.

An Eulerian code with Adaptive Mesh Refinement, xRAGE is ideally suited to studying subtle, fine-scale features and hydrodynamic instabilities. Eulerian codes incorporate a grid that is stationary with respect to fluid flow, resolving at fixed points, thereby making this code uniquely suited to studying the complex flows exhibited in ICF experiments. Such experiments take advantage of the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory.

Because xRAGE is a broad multi-physics simulation code, scientists can use it not only for ICF experiments but also for research associated with astrophysics, planetary defense, high explosives, and ballistic impacts. Laboratory scientists design and analyze experiments at premiere high energy density facilities such as NIF, the Omega laser facility, and the Z machines at Sandia National Laboratories. These experiments serve a variety of purposes, including applications in materials properties, laboratory astrophysics, fusion power development, and stockpile stewardship.

The new capabilities in xRAGE include laser ray-tracing with cross-beam energy transfer (in collaboration with the University of Rochester's Laboratory for Laser Energetics), new models to account for the complex transport of plasmas, and models for non-equilibrium processes for X-ray radiation. Such work complements additional verification and validation efforts to ensure that the physics models are implemented correctly. These new capabilities have now been used to perform numerous simulations that would not be possible in other codes, thanks to xRAGE's Eulerian hydrodynamics and adaptive mesh refinement.

More Than 60 Laboratory Staff Members Recognized with DOE Secretary's Honor Awards

More than 60 staff members on four different teams at the Laboratory recently earned Honor Awards from the Department of Energy Secretary — the greatest honor a DOE employee or contractor can receive. The DOE Secretary's Awards formally recognize the outstanding achievements of individuals and teams who have gone above and beyond in fulfilling DOE's mission. The four Los Alamos teams that received awards were as follows:

- **W76-2 Modification Team:** In recognition of the team's relentless dedication to engineering the submarine-launched W76 warhead, so that it possesses a low-yield capability.
- **Burning Plasma on the National Ignition Facility Team:** In recognition of the team's first-ever achievement at the National Ignition Facility at Lawrence Livermore National Laboratory. The team made advances in lasers, diagnostics, targets, and physics understanding of capsule coupling and compression that, when combined, enabled a three-fold increase in fusion performance in a period of a few months.
- **Nuclear Incident Response Stabilization Team:** In recognition of the team's extraordinary dedication to implementing the National Security Council-directed "Capability Forward" initiative, to field equipment and training to counter-weapons of mass destruction teams in 14 major metropolitan areas across the United States.
- **Lovelace Biomedical Research Institute Material Removal Team:** In recognition of the team's exceptional efforts to collaborate at the federal, state, and local levels to safely remove radioactive materials from the Lovelace Biomedical Research Institute under an intense and time-constrained schedule during the COVID-19 pandemic.

New DOE Funding "Powers" Fusion Materials Research

The promise of fusion — a potentially game-changing source of low-cost, abundant energy — faces a number of challenges, central among them the lack of materials that can withstand the extreme environments created during fusion reactions.

Now, a new project at the Laboratory will develop novel, tungsten-based alloys capable of handling such environments in fusion reactors — the material's unique design and fabrication potential brings the concept of fusion power much closer to realization. This work is thanks to \$3.1 million in funding from DOE's Advanced Research Projects Agency-Energy (ARPA-E) OPEN 2021 program.

In fusion, generating energy is typically not the main problem. The challenge of fusion is finding materials that can handle the intense conditions inside the reactor's harsh environment. This new project seeks to design and develop novel, tungsten-based, high-en-

trophy alloys (HEAs) for performance in plasma-facing components (PFCs). The plasma in a fusion reaction burns hotter than the temperature of the Sun. Thus, PFCs must maintain their thermomechanical properties and radiation resistance under extreme heat fluxes and radiation environments that could induce significant changes in structural and mechanical properties.

In addition to the fusion materials research, Laboratory researchers are also collaborating on two other projects funded in the ARPA-E OPEN 2021 program. The first, led by Carnegie Mellon University, involves working on ionomer-free electrodes to support improvements in polymer electrolyte membrane fuel cell technology. The second, led by Veir (a company based in Massachusetts), is developing superconducting power lines to carry more power on shorter towers and in narrower rights-of-way.

One Million Laser Zaps on Mars: SuperCam and ChemCam Celebrate an Impressive Milestone

Two Laboratory instruments currently on the surface of Mars have fired more than one million laser shots combined, an impressive milestone. The instruments — SuperCam (aboard the Perseverance rover) and ChemCam (aboard the Curiosity rover) — are tools that use lasers to search for chemical signs of past life on the Red Planet.

Perseverance, which recently celebrated its one year “land-iversary” on Mars as of February 18, 2022, and the Curiosity rover, which landed in 2012, have been busy exploring Mars and helping researchers better understand its potential for ancient microbial life.

Developed at the Laboratory, both instruments use a technique called laser-induced breakdown spectroscopy (LIBS) to zap rocks. These zaps create plasma, with the resultant light from such plasma collected so that scientists can better understand what elements are present on the planet’s surface. ChemCam has zapped its laser 885,000 times; SuperCam has fired its laser more than 115,000 times.

PBX 9751, a New High Explosive Material Approved for Use

In January 2022, the conventional high explosive (CHE) formulation X-0298 earned the designation of “Plastic Bonded explosive” (PBX), receiving the label PBX 9751. This powerful, degradation-resistant explosive offers

another option in the CHE toolbox of the DOE, NNSA, and the nation.

To create PBX 9751, Laboratory scientists and engineers restarted research efforts that began in 1974. They combined such legacy data with new work to shepherd the material through the last phase of the Laboratory’s high explosive development process. Laboratory scientists and engineers have recently produced several lots of PBX 9751, which personnel are pressing and machining into experimental parts. These experiments will continue to add to the knowledge base of PBX 9751.

In 2018, PBX 9701 became the first new PBX designated in decades. The 2022 designation of PBX 9751 affirms the Laboratory’s continued efforts to formulate and advance new explosives.

Tracking the Cells that Host HIV

New research has recently shed light on the lifespans and location of cells responsible for producing HIV, preventing its eradication. Understanding the dynamics of these cells may help scientists develop new ways to reduce their number, with the ultimate goal of curing HIV, the virus that causes AIDS.

According to Laboratory Senior Fellow Alan Perelson of Theoretical Biology and Biophysics (T-6), chronically HIV-1 infected individuals experience a decrease in the amount of virus in their blood when they are placed on potent antiretroviral drug therapy. Perelson and collaborator David D. Ho, an M.D. now at the Columbia School of Medicine, found that this “viral decline occurred in two distinct phases, a fast first phase followed by a slow second phase.”

In their new [paper](#), “Complex decay dynamics of HIV virions, intact and defective proviruses, and 2LTR circles following initiation of antiretroviral therapy,” Robert Siliciano, an M.D. from Johns Hopkins University School of Medicine and his team working with Perelson and Ruy Ribeiro (also of T-6), searched for the hypothesized cells with different decay rates. The paper was published in the journal *Proceedings of the National Academy of Sciences*.

Agility and Teamwork Lead to Successful SAVY Recoveries

Communication, teamwork, and agility — these signs of the cultural enhancements taking shape in the Laboratory's Plutonium Facility (PF-4) — helped crews work through challenges so that they could work safely to complete two SAVY recoveries for the Pit Technologies (PT) Division.

The first of these recoveries, started on February 9, 2022, was extended to the following day because only about a third of the items were recovered. The reason behind the less-than-expected recovery was due to questions that needed to be addressed. The recovery was completed in full on the following day.

The second recovery was scheduled for February 10, 2022. Ahead of that recovery, the Central Characterization Program (CCP) found errors in the original packing plan. PT Division made changes, created a new packing plan, and obtained approval so that the work could proceed. All teams supporting the second recovery also agreed to extend the project schedule by 90 minutes so the task could be completed. Oftentimes, if the work is not completed by the activity's end time, it has to be rescheduled for another day.

For both recoveries, the teams demonstrated flexibility while following good conduct of operations to ensure the jobs were completed safely. A special thanks to those involved in this work: CCP, Acceptable Knowledge team, Transuranic Waste team, Radiation Protection, Metal Production, and Foundry and Logistics.

ALT 941 Program Continues Steady Delivery of Products

On January 24, 2022, ALT941 components were diamond stamped with no Quality Assurance Defect Reports. These components were produced under a collaboration between Prototype Fabrication (PF), Product Agency Quality, and the Los Alamos Field Office (NA-LA).

These products from PF's Mark Quality Manufacturing Center (MQMC) will be shipped to the Kansas City National Security Complex. They not only meet the commitment for January 2022 but also satisfy 50 percent of the February Integrated Contractor Order Schedule commitment. This sale continues the MQMC's steady

and successful production in support of the ALT 941 Program.

Employee Town Hall Focuses on Updated Lab Agenda, Infrastructure Efforts, and Employee Housing

In his first Town Hall of 2022 viewed live by about 5,000 employees, Laboratory Director Thom Mason discussed how the new Lab Agenda would help guide the Laboratory's work this year in terms of hiring, infrastructure growth, and procurement.

The Lab Agenda defines the Laboratory's mission, goals and major deliverables for this year and in the coming decade, Mason said. The updated Agenda has four Strategic Objectives: nuclear deterrent, threat reduction, technical leadership, and trustworthy operations.

Mason also previewed significant plans for infrastructure, including the creation of a badge office in Central Park Square, changes to Canyon Complex, and progress on a leased building in Santa Fe that will provide office space for about 700 employees. Mason also touched on several transportation updates, including plans to improve bus services and engineering studies for a possible Omega Bridge replacement.

Nearby counties are beginning to respond to the Laboratory's request for more housing, with developments going up in Los Alamos and Santa Fe counties in particular. Mason also said the Laboratory is collaborating with Triad National Security, LLC, partner Texas A&M University to consider student housing in Los Alamos County.

Finance and Controller Divisions Develop and Adapt to Changes in COVID-19 Cost Reporting

In March 2020, the Laboratory's Finance (FIN) and Controller (CNTL) divisions developed a process to segregate, capture, and account for COVID-19 costs. From March 2020 to the end of 2021, this virus has cost the Laboratory \$65 million in labor, materials and supplies, and subcontractor-related expenses to address COVID-19 issues.

To ensure the full capture COVID-19 costs Lab-wide, the divisions developed projects and tasks specific

to the pandemic. For example, Payroll worked with Occupational Medicine to create new time and labor categories that collect the hours and associated costs of quarantined and sick individuals. In another effort, FIN management captured costs of personal protective equipment, cleaning, testing, tasks performed by the COVID-19 taskforce, incremental information technology, and situations that prevented employees from working onsite due to safety reasons.

To provide cost reports for indirect and direct programs, the divisions developed new project and task codes, along with labor reports and the number of leave hours used for COVID-19. Once the Coronavirus Aid, Relief, and Economic Security (CARES) Act passed, NNSA worked with sites to determine the detrimental impact of COVID-19 on NNSA and to determine possible federal reimbursement. Because the Laboratory was already reporting on COVID-19, NNSA based its reporting on that of the Laboratory.

As COVID-19 vaccines were mandated at the Laboratory, FIN adapted to NNSA's new reporting requirements, such as costs related to directly funded COVID-19 scientific efforts at the Lab, the cost of vaccine administration, the cost of approved leave for vaccines, and legal costs.

Four ALDFO Employees Recognized for Excellence in Substation Repairs

The NNSA's Los Alamos Acquisition and Project Management Office (LA-APMO) noted that four Laboratory employees went "above and beyond the call of duty" during October 21, 2021 to replace a failed potential transformer (PT) at an electrical substation. The four employees are Kedrick Mendez and Serafin Vigil of the Logistics Division, as well as Heather Bergren and Alynna Montoya-Wiuff of the Engineering Services Utilities and Infrastructure Group.

In recognition of the initiative and ingenuity demonstrated by the four employees of the Associate Laboratory Directorate for Facilities and Operations (ALDFO), LA-AMPO sent a letter of commendation. The letter noted that the four "excelled in acquiring the proper parts in an expedited fashion and worked as a team to get the TA-3 substation back in operation."

The letter noted that the four ALDFO employees saved the project several months in fabrication and delivery time by reaching out to industry peers to locate re-

placement parts and materials. The original lead-time for replacement parts and materials ranged from 8 to 14 weeks, but the team realized onsite delivery within three weeks, thereby enabling the Laboratory to complete the project and energize the new substation before the winter closure.

Human Resources Launches a New Dependent Caregiver Employee Resource Group

Thanks in part to the Laboratory's Human Resources Division, a new Employee Resource Group (ERG) has been formed specifically for dependent caregivers. The Dependent Caregiver ERG's mission is to support and empower Laboratory employees who are caregivers for one or more dependents of any age.

This ERG seeks to provide a supportive and welcoming environment by providing information, advocacy, and resources for dependent caregivers. It is committed to promoting and sustaining an inclusive culture in which caregivers are treated with parity and are encouraged to seek a work-life balance that accommodates career goals alongside family and home needs.

The Dependent Caregiver ERG encourages membership from all kinds of dependent caregivers such as biological parents, adoptive parents, foster parents, stepparents, legal guardians, caregivers of adults who need special care, and caregivers of the elderly. Membership is open to all who wish to help identify and address issues faced by dependent caregivers — members need not be dependent caregivers themselves.

The Dependent Caregiver ERG Champion is James Owen, the Associate Laboratory Director for Weapons Engineering.

"As I talk to friends, colleagues and co-workers, I find there are many who have similar responsibilities for their parents, grandparents, and others at any age who need special care," said Owen. "The Dependent Caregiver ERG, which seeks to provide a supportive environment for dependent caregivers, is a welcome addition to the Lab's various ERGs. Lab employees will now have access to a community focused on dependent caregiving, which means better availability for resources such as information, awareness, and advocacy for the issues they face. I look forward to helping our caregivers find ways to meet and balance their family and work goals."

Institutional Facilities Establishes Training Series to Bolster Conduct of Operations

The Institutional Facilities (IF) Division under the Associate Laboratory Directorate for Facilities and Operations (ALDFO) recently established a boot camp/training series to enhance disciplined operations. To achieve such enhancement, this series will strengthen Laboratory-wide knowledge of Conduct of Operations, Conduct of Maintenance, and Integrated Work Management.

Although an increase in COVID-19 cases briefly interfered with this series, it nevertheless progressed, with attendees covering the gamut, including operators, building managers, operations managers, maintenance management, planners, superintendents, and IF's customer High Performance Computing. Future sessions have been scheduled for February 2022, with deployed personnel from ALDFO's Engineering Division and the Environment, Safety, Health, Quality, Safeguards and Security Directorate both scheduled to attend.

Following the Conduct of Operations workshops will be sessions that address Conduct of Engineering, Conduct of Maintenance, and Integrated Work Management.

Laboratory's HR-Institutional Training Services Group Collaborates with Texas A&M to Improve, Modernize Training

Working in collaboration with Texas A&M Engineering Extension Service (TEEX), the Laboratory's Human Resources-Institution Training Services (HR-ITS) group has redesigned, modernized, and consolidated several of the Lab's e-learning training courses. Improvements to these training courses include the following:

- a new standard training template that provides a common look and feel,
- embedded activities designed to engage trainees,
- knowledge checks along the way to review materials, and
- increased rigor of quizzes to validate learning.

Newly designed courses include the following:

- *Hazardous Materials Packaging and Transportation: Drug and Alcohol Awareness for Supervisors,*

- *Hazardous Waste Transport, and*
- *LAFD Glove Box Fires: Plutonium/Pyrophoric Metal Fires.*

Members of HR-ITS are reviewing the required new-hire trainings and will update and modernize them next, starting with the oldest first.

Laboratory's Information & Technology Opens New Locations to Serve Employee IT Needs

Information & Technology's EasyIT organization at the Laboratory recently opened new locations to meet institutional demand. These locations offer walk-in service for employees to purchase equipment at

- the new Santa Fe office building located on Guadalupe St.,
- the New Employee Training building at TA-55, and
- the newly renovated Study Center.

Along with these new locations, EasyIT has added new tools to help streamline day-to-day operations, such as the following:

- a computer-request tool to process and track computer orders,
- an email portal to quickly address and track customer inquiries,
- a charging tool to process sales and streamline recharge operations, and
- an account-request tool to document and track requests to employee accounts.

The Laboratory's eXperience IT (XIT) Division has opened two tech desk locations that offer walk-up tech support service at

- the Central Park Square drop-in space, and
- the Otowi building.

These new locations and tools help enhance the Laboratory's operational culture by proactively adapting to meet the ongoing needs of customers.

Laboratory's Information & Technology Updates Bluetooth Policies

The Laboratory's Information & Technology (I&T) recently updated its Bluetooth policies and completed an awareness campaign to employees that clarified

their responsibilities regarding Bluetooth and wireless technology. I&T released information to all employees about policies P213, *Cybersecurity Wireless Computing Devices*, and P217, *Controlled Portable Electronic Devices*.

The updated policies, which went into effect at the beginning of the year, state the following: “Enablement, and use, of Bluetooth is not permitted on any LANL computing asset. This includes laptops, small form desktops, workstations and servers. This restriction does not apply to LANL issued iOS devices such as iPhones and iPads when in use outside of a Limited Area or higher.”

I&T reached employees through the internal news webpage and through the daily LANLToday newsletter. The information also included instructions for reaching I&T for technical assistance, if needed. It also emphasized user responsibility to remain consistent with the security settings that I&T sets up for users during the initial setup process of new computers. These policy updates and the subsequent awareness campaign for employees help enhance the Laboratory’s security culture.

LANL Lab Agenda has a New Structure to Map the Future

Over the past several years, the Laboratory has experienced substantial growth in people, procurements, facilities, and missions. At the same time, there is ongoing scientific work, in addition to expanding responsibilities in pit production. To provide a roadmap that shows how everything gets done, the Laboratory this week released an updated Lab Agenda for employees and interested stakeholders.

An evolving and strategic document, this latest Lab Agenda helps the Laboratory plan, prioritize, and communicate goals and mission needs. One of the significant changes is that the Lab Agenda now focuses on outcomes rather than how the Lab is organized. It revolves around four strategic objectives and the measurable end states, or “critical outcomes,” essential to meeting each of those objectives. The strategic objectives are nuclear deterrent, threat reduction, technical leadership, and trustworthy operations.

The Laboratory leadership team felt it was important to lay out what all these points look like over the next ten years. Laboratory Director Thom Mason said there are both aspirational and tactical elements in the new plan because the Laboratory has to keep prioritization

in mind, especially in the next two years as work ramps up.

This updated Lab Agenda also looks to reinforce that the Laboratory’s work is interdependent and all parts of the Laboratory must work together to achieve common goals.

Leadership Development Program Kicks Off Second Cohort

When leadership for the Laboratory’s Weapons Production hosted round-table discussions with first-line managers (FLMs) within the directorate, they noted that FLMs desired to keep building core management and leadership capabilities, as well as have additional opportunities to practice and apply tools and concepts in their daily routine as managers. Although FLMs spend the bulk of their time focused on logistics work (planning, scheduling, supervising operations, managing finances, and interacting with stakeholders), they wanted to be just as skilled — perhaps even more — at creating a culture of teamwork, employee engagement, and safe environments both in conduct of operations and in their working relationships.

In response to this feedback, leadership in the Associated Laboratory Directorate for Weapons Production (ALDWP) created the ALDWP Leadership Development program. Kicked off in 2021, this program initiated its pilot cohort with the support of Human Resources’ People and Organizational Development (HR-POD). In 2022, 16 new FLMs were selected for a seven-month program that holds monthly modules led by program and senior leaders within the directorate. The program kicked off its 2022 cohort last month and will support cultural enhancement and professional development opportunities across ALDWP.

Logistics HERG Crews in ALDFO Respond to Winter Weather to Help Ensure Worker Safety

The Laboratory’s Heavy Equipment Roads & Grounds (HERG) group proactively responded to snowfall in January and February 2022. More than 260 workers in the Logistics Division under the Associate Laboratory Directorate for Facilities & Operations (ALDFO) removed snow and cleared sidewalks while temperatures hovered at near-zero degrees.

From January 27–30, 2022, 111 mechanics, laborers, masons, operators, and teamsters put in more than

1,000 hours to remove the accumulated five inches of snow campus-wide. Through February 7, 2022, 150 mechanics, laborers, masons, operators, and teamsters worked nearly 3,500 hours to remove snow and clear sidewalks after an additional 10–12 inches of snow fell from February 1–3, 2022.

Throughout these events, the Laboratory's craft worked rotating 12-hour shifts to clear roads, parking lots, and sidewalks. They applied ice slicer, salt, and potassium acetate (another type of salt) to enhance safety and help prevent injury on sidewalks and other walkways.

By clearing the snow and salting walkways during those frigid early mornings, the craft illustrated disciplined operations, a commitment to safety, and a clear understanding and execution of the Safe Conduct of Research (SCoR) principles that ensure safe operations, particularly when it came to SCoR's principle to maintain healthy respect for what can go wrong.

Los Alamos Pit Production Project Team Receives High Praise for important Piece of Decontamination & Decommissioning Subproject

A team of more than 45 employees from the Capital Projects and Plutonium Infrastructure directorates received high praise from the NNSA when they completed an important step in the Los Alamos Pit Production Project process. Not only did the team complete the Baseline Change Proposal paperwork for the decontamination & decommissioning subproject in half the time that is typically allotted for such activities, they also submitted a package that exceeded the customer's high expectations.

Completing a Baseline Change Proposal and "snapping" the baseline are two of the first major steps a project team must tackle to complete a federally funded project. These steps establish the formal scope, schedule, and cost baseline for a project. The baseline paperwork details the project scope, schedule, and budget — all of which personnel will use once work on the project begins — to measure progress and the overall success of the project.

The undertaking was complex and involved very senior project controls-type work, which was performed by a team that had never implemented a baseline before. Guided by a standard of disciplined operations, they

met daily to ensure there were no missteps and, as a result of such discipline, moved through the process efficiently and effectively.

Now that the schedule and budget have been approved by the NNSA, the execution phase of this subproject can begin. The project controls team is preparing to use the same process for the remaining subprojects, with plans to proceed as soon as each portion gets the green light to do so.

New Partnership to Attract Engineers to Contribute to National Laboratory Missions

The Laboratory is participating in the UCI-National Labs Connections initiative in collaboration with the University of California, Irvine (UCI), Samueli School of Engineering. This partnership is expected to aid in building the Laboratory's future workforce.

Los Alamos is the first national lab in a growing partnership between UCI and several DOE national labs that will help create advanced educational opportunities for students and workforce development in areas that align with national lab missions.

Following a two-day kickoff workshop in December 2021, UCI established the UCI Engineering-Los Alamos National Lab graduate fellowships. These fellowships will be overseen by a joint UCI-LANL committee and go toward supporting graduate research in the areas of climate and environment, renewable energy, and materials and chemical research.

Operational Readiness Review Reveals Effective Conduct of Operations in HAZCAT-3 Facility

As part of the HAZCAT-3 (Hazard Category) Contractor Operational Readiness Review (CORR) assessment, personnel on February 10, 2022, held an operational drill in a laboratory at the Radiological Laboratory/Utility/Office Building (RLUOB) at TA-55. The CORR team observed this drill, which demonstrated the response to a scenario of a glove breach in a hot glovebox at the nuclear facility.

The drill yielded excellent results, with employees at TA-55 demonstrating a good understanding of performance expectations, including the expectation of the entire workforce to pause or stop work when things do

not look or feel right. The CORR team noted the following observations:

- strong commitment to conduct of operations, evidenced during the performance of evolutions,
- healthy attitude towards safety and an understanding of the need to raise concerns about safety, nuclear safety, quality, or other issues without fear of retribution,
- professional attitude towards coworkers, evaluators, leadership, and oversight personnel, and
- strong sense of ownership and willingness to take issues seriously.

The drill was thorough and critical, with the team discussing communications, coordination, and other opportunities for improvement. Overall, the drill was run well, responses were as expected, and there were no issues noted by the CORR team.

The RLUOB team properly addressed the issues raised in the drill, revealing the institutional gains made by recent improvements in employee engagement and safety measures.

Pit Technologies Employees Pause Work to Ensure Safety

Some members of the metal production group in Pit Technologies are being recognized for a “good catch” during the week of January 16, 2022. As members of this team opened a Savy-4000 container, a type of container approved for special nuclear material (SNM), they noticed a powder material, which they did not expect to be there.

Applying the “everyone is personally responsible for ensuring safe operations” principle from the Safe Conduct of Research (SCoR), the team members immediately paused work, called a potential process deviation (PPD), and informed Nuclear Material Control and Accountability about the possible issue. A team that responded to the PPD posted the glovebox as out of service while they bagged out the material for analysis. Test results showed the amount of SNM was sub-accountable (less than 1 gram), so the glovebox was put back in service and work resumed.

Simplifying Property Management at the Laboratory Yields Benefits

Based on suggestions and feedback from group leaders, on January 19, 2022, personnel updated Laboratory policy P821: Government Personal Property. Specifically, property specialists removed the requirement for the annual renewal of Property Transfer Requests (PTRs). Such removal has vastly simplified property management processes and set a course for the Laboratory to realize a major annual administrative cost avoidance.

There are currently 9,847 accountable property items on PTRs at the Lab. Fully reviewing and processing each PTR requires an estimated minimum of one hour of combined time between a property specialist, an organizational computer security representative, and a responsible line manager. The policy update allows Laboratory employees to use approved PTRs for the lifetimes of their current equipment, cutting out the need for time-consuming yearly renewals.

Managers also suggested timesaving improvements for the annual inspection of mechanical material handling equipment and the signature process on material control and accountability (MC&A) forms. The Laboratory Operations Council is working on those recommendations with the appropriate program owners.

Understanding PF-4 Holdup Supports Removal of Equipment in Inactive Areas

In January 2022, the Nuclear Process Infrastructure (NPI) group in Weapons Production completed holdup measurements for inactive locations within the Laboratory’s Plutonium Facility (PF-4).

This component of an institutional-level milestone was completed to establish baseline holdup inventory for inactive process areas, develop and implement a statistical sampling plan for periodic validation of holdup in inactive processing areas, and transfer the nondestructive assay (NDA) measurement information to MC&A (Material Control and Accountability) and thus submit a closure package.

Understanding holdup supports the ability to remove equipment in inactive process areas, perform criticality evaluations based on measured holdup, and support MC&A. Personnel have measured more than 50 loca-

tions throughout PF-4 to support NDA holdup measurements.

Weapons Production Employees Work Through Challenges to Machine Shell for Pit Production

On February 1, 2022, as a winter storm approached Los Alamos, about a dozen employees from Weapons Production (WP) worked to complete the rough machining of a shell used for pit production. Not only did the team members complete the shell, they also during the operation safely overcame obstacles, such as a stripped screw and a machine error caused by the CNC-1 lathe.

To address the lathe problem, WP workers collaborated with an engineering team and deployed security to pursue parallel paths to reload the machining program and find an alternate path to send the part through nondestructive evaluations before final machining. A quick response from all the support organizations enabled the machine to return to operation.

The team stayed late to ensure workers completed the part before the snowstorm, which stopped onsite activities for two consecutive days. This team's commitment to safety and teamwork, while meeting the mission, reflects the institutionalized gains in disciplined operations made in the Associate Laboratory Directorate for Weapons Production through training and employee engagement.

COMMUNITY RELATIONS

Bradbury Science Museum Reaches Out to Regional Students

Despite challenges related to the COVID-19 pandemic, the Laboratory's Bradbury Science Museum and its educators continue to drive valuable education outreach activities with schools in northern New Mexico.

Beginning in February 2022, museum personnel have initiated interactive, virtual field trips to McCormick Elementary, serving 21 students in the fifth grade. Personnel have also conducted similar field trips to the Santa Fe School for the Arts and Sciences (24 students in the seventh grade) and El Camino Real STEAM Day (with students from the fourth to eighth grades).

In addition, the Bradbury's Science on Wheels program on February 15, 2022, saw museum educators travel to

Santo Domingo School to work with 52 students from fourth and fifth grades.

In-person class visits to Bradbury resume on February 16, 2022. Scheduled are Tierra Encantada Charter School on February 16, 2022 (40 students from eleventh and twelfth grades) and Española Valley High School on February 17, 2022 (24 students from the ninth grade).

Laboratory Scientists for Fifth Year Lead Volunteer Efforts at Los Alamos County Science Fair

In January 2022, the Los Alamos County Science Fair was conducted using a new virtual format. Several Laboratory staff members proved instrumental to the continued success of this local event.

Head judges Cathy Snelson and David Coblenz (both from EES-17, Geophysics), as well as Mark Petersen (CCS-2, Computational Physics and Methods), recruited and organized 36 judges from across the Laboratory and community to evaluate 65 projects from participating students in the fourth to twelfth grades. The lead team managed all judging logistics, including tasks such as coaching volunteer judges, supporting students, participating in judging projects, and coordinating with staff from the Los Alamos Public Schools (LAPS).

In addition to posting their projects on a virtual platform, which enabled judges to provide guidance to all competitors, Junior and Senior High School Division students participated in interviews with judges who then provided constructive scientific and entry feedback. Thirty-four LAPS students qualified (at County and then Districts) to advance to this year's Northeastern New Mexico Regional Science & Engineering Fair, which will be held March 12, 2022.

During the five years that Cathy Snelson and David Coblenz have served as Head Judges for the Los Alamos County Science Fair, nearly 1,000 LAPS students have participated, with many progressing to compete and win top awards at Regional, State, and International levels. Throughout their tenure, Snelson and Coblenz standardized the judging rubric, recruited numerous new volunteer judges, identified consistent leads for subject categories, and streamlined the best-of-show nomination process. All these efforts have built on Los Alamos' strong history of science fair competitions to

provide a meaningful and enriching experience for local students.

Summer Physics Camp for Young Women Ready to Accept 2022 Applications

From June 7 to 17, 2022, female scientists and engineers at the Laboratory will teach short courses for a virtual, free-of-charge Summer Physics Camp for Young Women. The camp is currently accepting applications for middle- and high-school students. Space is limited to 35 campers for 2022.

At this camp, students will receive materials to conduct hands-on experiments and group projects at home. They also will attend virtual presentations and demonstrations. Among the presenters will be about 90 Laboratory scientists, engineers, and other professionals — approximately 75 percent of these presenters are female.

Camp sessions will also cover professional-development skills, such as resumes, interviews, college opportunities in New Mexico, professional societies, and internships/careers at the Laboratory. To qualify, campers must be young women who live in northern or central New Mexico, as well as tribal communities. They must have completed at a minimum Algebra 1. Campers will receive a stipend upon completion of the camp.

Of 2021's pool of 35 campers, 16 have gone on to secure internships at the Laboratory for summer 2022.

SELECTED MEDIA COVERAGE

['Atomic Armor' for Accelerators Enables Discoveries](#)

Phys.org (1/25)

Researchers at Los Alamos National Laboratory have developed and tested an atomically thin graphene coating for next-generation, electron-beam accelerator equipment — perhaps the most challenging technical application of the technology, the success of which bears out the potential for “Atomic Armor” in a range of applications.

[LANL Announces 2021 AAAS Fellows: Babetta Marrone, Thomas Mark McCleskey, and Harshini Mukundan](#)

Los Alamos Daily Post (1/27)

Three Los Alamos scientists have been named fellows of the American Association for the Advancement of

Science (AAAS). Election to AAAS fellowship is an honor bestowed upon AAAS members by their peers for their scientifically or socially distinguished efforts to advance science or its applications. The new fellows are Babetta Marrone, Mark McCleskey and Harshini Mukundan.

[Physicists Report First Creation of Self-Heating Plasma for Nuclear Fusion](#)

Axios (1/27)

Nuclear physicists are notching scientific advances for fusion energy, fueling hopes — and billions in investment — to create an energy source that doesn't produce carbon or nuclear waste.

[Progress in Hybrid Algorithms Makes Small, Noisy Quantum Computers Viable](#)

SciTech Daily (1/28)

As reported in an article in *Nature Reviews Physics*, instead of waiting for fully mature quantum computers to emerge, Los Alamos National Laboratory and other leading institutions have developed hybrid classical/quantum algorithms to extract the most performance—and potentially quantum advantage—from today's noisy, error-prone hardware. Known as variational quantum algorithms, they use the quantum boxes to manipulate quantum systems while shifting much of the work load to classical computers to let them do what they currently do best: solve optimization problems.

[LANL Spent \\$505M with State Businesses](#)

Albuquerque Journal (1/29)

Los Alamos National Laboratory spent \$505 million with New Mexico businesses in 2021, and had 12,919 employees with a payroll of \$1.3 billion.

[What is the Grandfather Paradox?](#)

Live Science (1/31)

But would that really be the case, using the quantum approach to the grandfather paradox? Recent work at the Los Alamos National Laboratory indicates that the course of history is more resilient than the butterfly effect might suggest.

[World Record 477-Mile-Long Lightning 'Megaflash' Confirmed Over U.S.](#)

Washington Post (1/31/)

The World Meteorological Organization announced on Monday that it had confirmed two new mind-blowing lightning “megaflash” records. The findings, which come after careful data-checking and rigorous certification processes, include one record event that occurred over the Lower 48 states. “Detecting these extreme lightning events is very difficult due to their exceptional rarity and scale,” wrote Michael J. Peterson

of the Space and Remote Sensing Group at Los Alamos National Laboratory.

[More Than 60 Los Alamos National Laboratory Staff Members Recognized with DOE Secretary's Honor Awards](#)

LA Daily Post (2/1)

More than 60 staff members on four different teams at Los Alamos National Laboratory (LANL) were recently recognized with Honor Awards from the Department of Energy Secretary — the highest honor a DOE employee or contractor can receive.

[New Mexico Asks National Guard to Work as Substitute Teachers to Keep Classrooms Open](#)

Capradio (2/2)

In a sunny classroom in Pojoaque Valley Middle School, northern New Mexico, a class of lively teenagers is doing a group reading exercise. Specialist Austin Alt paces around, peering over their shoulders. It's his second day as a substitute teacher, and his arrival came as a surprise. . . . Alt is 25 and has no teaching experience, usually working as a technician in the laboratories at Los Alamos. He says he volunteered after seeing his younger brother's struggle with remote learning.

[LANL: Laboratory Spent \\$505 Million with New Mexico Business, \\$1.3 Billion in Employee Salaries in 2021](#)

Los Alamos Reporter (2/3)

New data for fiscal year 2021 shows Los Alamos National Laboratory's big impact on New Mexico's economy, as the Laboratory employed 12,919 people for a total of \$1.3 billion in salaries and spent \$505 million with businesses statewide.

[Tracking the Cells that Host HIV](#)

Medical Express (2/3)

New research sheds light on the lifespans and location of the cells that are responsible for producing HIV, preventing its eradication. Understanding the cells' dynamics may help scientists develop new ways to reduce their number with the ultimate goal of curing HIV infection.

[The Hydrogen Stream: New Fuel Cell Design to Solve Longstanding Problem of Overheating](#)

PV Magazine (2/4)

Los Alamos National Laboratory researchers developed a new polymer fuel cell that is claimed to solve the long-known issue of overheating.

[LANL Helps Community Locate Water Supply](#)

KRQE (2/4)

Los Alamos National Laboratory is helping a local community figure out where its water is coming from. Greg Swift is with the Acequia de Los Indios, a community association in El Rancho south of Espanola.

[Los Alamos National Laboratory's Interactive Periodic Table One of the Web's Very First — Ever!](#)

Los Alamos Reporter (2/4)

In 1992, when just a handful of webpages populated the newly established World Wide Web, a graduate student at Los Alamos National Laboratory did something extraordinary: he launched one of the web's first-ever interactive periodic table of elements — and it still exists today.

[Is the Mysterious 'Space Diamond' for Real? An Investigation.](#)

Mashable (2/5)

"It's not a single crystal. It's actually millions of crystals," said Terry Wallace, a geologist and the former director of Los Alamos National Laboratory.

[LANL Scientists Capture Two Record-Breaking Lightning Megaflashes](#)

KOB-TV (2/7)

Lightning megaflashes are rare and they're difficult to record, especially from the ground. "You'd have to put your instrument in just the right place at just the right time to have a chance of even measuring a portion of the megaflash," Los Alamos National Lab scientist Michael Peterson said.

[LANL Makes Headway in Predicting Earthquakes](#)

KOB-TV (2/8)

Many people believe that earthquakes are unpredictable, but are they really? While no major earthquake has ever been predicted, scientists at Los Alamos National Lab might just be closing in on the solution.

[News Feature: Climate Change Hastens Disease Spread Across the Globe](#)

PNAS (2/9)

In a 2019 article, Morgan Gorris, a postdoctoral Earth system scientist at Los Alamos National Laboratory near Santa Fe, NM, examined moderate and severe future climate warming scenarios across the United States. She found that under the severe climate warming scenario, suitable conditions for the fungus could reach as far north as the US-Canadian border by the end of this century.

[Exploration of Two-Dimensional Perovskite in Device Settings Yields Promise for Technology](#)

Phys.org (2/10)

In research published in the journal *Chem*, Los Alamos National Laboratory researchers have examined the performance properties of two-dimensional perovskites in conditions representative of a device structure, finding those structures can be as efficient as their three-dimensional counterparts.

[Los Alamos National Laboratory Working on Asteroid Defense](#)

KRQE-TV (2/10)

Scientists at Los Alamos National Laboratory are studying asteroids in the hopes of being better prepared to defend the earth against them.

[Los Alamos National Laboratory's Primary Contractor Received an Overall Good Rating on a Federal Report Card](#)

Santa Fe New Mexican (2/10)

The yearly report card assessed how well Triad National Security LLC met its goals set for 2021, rating the contractor "very good" with 87.3 percent of the highest possible score, nearly identical to last year's 88 percent.

[Triad National Security, LLC to Receive \\$46.7 Million, 87.3 Percent in Award and Fixed Fees for Fiscal Year 2021](#)

Los Alamos Reporter (2/10)

Triad National Security, LLC has earned an overall "Very Good" rating and an overall 83.7 percent of its award fee for its Managing & Operating contract at Los Alamos National Laboratory for FY2021. The total amount awarded is \$46.7 million out of almost \$50 million that was available.

[Los Alamos National Laboratory Scientists Help Probe HIV's Durability](#)

Santa Fe New Mexican (2/12)

A team of scientists, including two Los Alamos National Laboratory researchers, is delving into how infected cells decay at different rates in the quest to find a cure for the disease.

[LANL Scientists Record Pair of Megaflash Lightning Records in 2020](#)

Albuquerque Journal (2/12)

Los Alamos National Laboratory scientists – using lab software and a series of new satellites – recorded a pair of lightning megaflashes in 2020 that recently were confirmed as setting new records of distance and duration.

[Tiny Beetle Hits Forests Hard in Warm Droughts](#)

Santa Fe New Mexican (2/13)

In warm droughts, trees lose more water to the atmosphere through their leaves and needles. In warm winters, beetles in greater number survive the cold, while an earlier spring gives beetles a head start on their reproductive cycle. Under these climate-change conditions, beetle population growth accelerates quickly as tree defenses wither.

[LANL: A Love Lost, an International Escape, and an Intentional Friendship](#)

Los Alamos Reporter (2/14)

During the Manhattan Project, Edith Warner ran a tearoom open only to laboratory staff — but she didn't do it alone. Warner baked cakes and served scientists while Tilano Montoya gathered well water and kept the wood stove fed. Their regulars included the likes of Manhattan Project Director J. Robert Oppenheimer and physicists Niels Bohr and Enrico Fermi.

[Black History in the Making: Michelle Lee Started at Los Alamos National Laboratory as an Intern. Today She Runs the Internship Program](#)

ASBMB Today (2/15)

Today Lee works as a health physicist at LANL, performing research and shaping policies that help staff and scientists work safely with radioactive materials such as plutonium.

[LANL Grants to Benefit Luna Students](#)

Las Vegas Optic (2/15)

Luna Community College students and the local area stand to benefit from a pair of recent Los Alamos National Laboratory grants.

[LANL Scientists Keep an Eye on the Sky](#)

KOB 4 (2/17)

A new Netflix movie has a lot of folks wondering what's going on in space. Well, there are scientists at Los Alamos National Lab keeping an eye on things, especially asteroids.

[This is how Los Alamos, Sandia National Labs Earned Millions in Taxpayer Dollars](#)

Carlsbad Current-Argus (2/17)

New Mexico's two nuclear laboratories received millions in federal funds for their performance in the last year, based on evaluations published last week and conducted by the U.S. Department of Energy into research activities and development.

Research Aims to Mitigate Chemical and Biological Airborne Threats

TechXplore (2/18)

The researchers are still processing the approximately 5,000 samples that were collected over the five-day measurement campaign. The data will feed into existing particle dispersion models to improve simulations. One of these models, from Argonne National Laboratory, focuses on subway environments, and another model from Los Alamos National Laboratory simulates above-ground city environments, taking into account buildings and urban canyon air flows.

High-Flying NASA 'NACHOS' Instrument May Help Predict Volcanic Eruptions

Environmental News Network (2/21)

"A dormant volcano just waking up may emit SO₂ before there is any detectable seismic activity. That gives us a chance to identify a potentially erupting volcano before it actually blows," said Steve Love, a researcher and task lead with the Space and Remote Sensing Group at the Department of Energy's Los Alamos National Laboratory (LANL).

Fusion Power is Coming

Quillette (2/21)

The meetings to plan the ITER program began in the early '80s, and by the summer of 1985 it was already viewed as a "scandal" by many working in the front lines of the fusion program. At that time I was part of an engineering team at Los Alamos National Lab working on the first design of a fusion reactor based on the then very advanced Spherical Tokamak, or ST, concept.

NASA's New "NACHOS" Instrument Could Help Predict Volcanic Eruptions

CBS News (2/22)

"A dormant volcano just waking up may emit [sulfur dioxide] before there is any detectable seismic activity. That gives us a chance to identify a potentially erupting volcano before it actually blows," Steve Love, a researcher with the Space and Remote Sensing Group at the Department of Energy's Los Alamos National Laboratory, said in a NASA press release.

A New A.I. Technique Could Accelerate Scientific Discoveries

Real Clear Science (2/23)

To plug the gap between the two types of models, a Los Alamos National Laboratory team developed an AI technique that learns from the ocean-ecosystem modeling generated by E3SM to make estimated ecosystem information available to the short-term prediction models.